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**OCT 12 2007**

Serial No. 10/736,922  
60246-223; 10692

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Appellant: Wei  
Serial No.: 10/736,922  
Filed: December 16, 2003  
Group Art Unit: 1753  
Examiner: Mayekar, Kishor  
Title: BIFUNCTIONAL LAYERED  
PHOTOCATALYST/THERMOCATALYST FOR IMPROVING  
INDOOR AIR QUALITY

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Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

**APPEAL BRIEF**

Dear Sir:

Subsequent to the filing of the Notice of Appeal on August 14, 2007, Appellant hereby submits its brief. All appeal fees were paid with Appellant's prior appeal of 14 July 2006. Any additional fees or credits may be charged or applied to Deposit Account No. 03-0835 in the name of Carrier Corporation.

**Real Party in Interest**

The real party in interest is Carrier Corporation, the assignee of the entire right and interest in this Application.

**Related Appeals and Interferences**

The subject application was previously appealed on 14 July 2006 and an Appeal Brief was filed on 12 September 2006. The Examiner reopened prosecution in response to the Appeal Brief.

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Additionally, commonly owned co-pending application 10/736,921, which is also related to photocatalysts, is also under appeal with the same examiner.

#### **Status of Claims**

Claims 15, 16, and 19 were previously cancelled. Claims 1-14, 17, 18, and 20-47 stand rejected and are appealed.

#### **Status of Amendments**

All amendments have been entered.

#### **Summary of Claimed Subject Matter**

As shown in Figure 5, the subject application relates to a purification system 10 including a substrate 28 having a first surface portion (of surface 54) and a second surface portion (of surface 54) adjacent the first surface portion, and a layered catalytic coating 40. The coating 40 includes a first layer 44 of one of metal/titanium dioxide and metal compound/titanium dioxide applied on said first surface portion and a second layer 46 of one of titanium dioxide and metal compound/titanium dioxide applied on said second surface portion (page 13, paragraph 63, lines 1-6). This basic structure is set forth in Independent Claim 1.

Independent claim 20 recites a fluid purification system 62 including a container having an inlet 22 and an outlet 36, a porous substrate 28 inside the container and having a first surface portion and a second surface portion adjacent the first surface portion (page 13, paragraph 63, lines 1-6), and a device 34 for drawing a fluid into the container through the inlet 22, flowing the fluid through the porous substrate 42, and expelling the fluid out of the container through the outlet 36 (page 5, line 21 to page 6, line 2). The fluid purification system 62 includes a layered catalytic coating 40 including a first layer 44 of one of metal/titanium dioxide and metal oxide/titanium dioxide applied on the first surface portion and a second layer 46 of one of titanium dioxide and metal oxide/titanium dioxide applied on the second surface portion (page 6, lines 21 to 26). An ultraviolet light source 32

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activates the layered catalytic coating 40, and photons from the ultraviolet light source 32 are absorbed by the layered catalytic coating 40 to form a reactive hydroxyl radical. The reactive hydroxyl radical oxidizes contaminants in the fluid that are adsorbed onto the metal/titanium dioxide catalytic coating 40 when activated by the ultraviolet light source 32 to water and carbon dioxide in the presence of water and oxygen (page 6, lines 6 to 20).

Independent claim 21 recites a fluid purification system 62 including a first substrate 64 having a first coating 44 of one of metal/titanium dioxide and metal oxide/titanium dioxide and a second substrate 66 having a second coating 46 of one of titanium dioxide and metal compound/titanium dioxide (page 15, lines 11 to 26).

Independent claim 33 recites a method of purification including the steps of applying a layered catalytic coating 40 including a first layer 44 of one of metal/titanium coating and metal oxide/titanium dioxide on a first surface portion of a surface 54 of a substrate 28, applying a second layer 46 of one of titanium dioxide and metal oxide/titanium dioxide onto a second surface portion of the surface 54 of the substrate 28 that is adjacent the first surface portion (page 7, paragraph 37, lines 4-8; page 8, paragraph 41, lines 3-6; page 9 paragraph 43, line 1 through paragraph 46, line 7, and activating the layered catalytic coating 40 (page 6, paragraph 31, lines 1-4).

#### **Grounds of Rejection to be Reviewed on Appeal**

- I. Whether Claim 47 is properly rejected under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement.
- II. Whether Claim 47 is properly rejected under 35 U.S.C. §112, second paragraph as being indefinite.
- III. Whether Claims 1-14, 17, 18, 34, 36, 45, and 46 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kobayashi, et al. (U.S. 6,368,668, hereafter "Kobayashi").
- IV. Whether Claim 35 was properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kobayashi in view of Reisfeld, et al. (U.S. 2003/0021720, hereafter "Reisfeld").

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V. Whether Claims 7-12, 20, 33, 37, 38, 43, and 44 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kobayashi in view of Reisfeld.

VI. Whether Claims 21-32, 39-42, and 47 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Reisfeld in view of Kobayashi.

### Arguments

#### **I. Rejection of claim 47 under 35 USC §112, first paragraph.**

The Examiner argues that the subject matter of claim 47 comprises new matter that has no support in the specification as originally filed. Respectfully, Figures 7-10 of the application suggest multiple honeycomb substrates, and Figure 5 and paragraph 63 of the application disclose the "first surface portion and a second surface portion adjacent the first surface portion" of claim 47. More specifically, Figure 5 and paragraph 63 of the application disclose a honeycomb 28 having a layer 44 of metal/titanium dioxide or metal compound/titanium dioxide applied on a first portion of the surface 54 of the honeycomb 28 and a layer 46 of titanium dioxide or metal compound/titanium dioxide applied on a second surface portion of the surface 54 of the honeycomb 28. Additionally, Figures 7-10 of the application disclose using multiple honeycombs. Therefore, Figure 5 in combination with Figures 7-10 provides support for claim 47 that at least one of the honeycomb structures as illustrated in Figures 7-10 could include the example honeycomb structure as illustrated in Figure 5. For this reason, there is support for the limitations of claim 47, and the rejection should be reversed.

#### **II. Rejection of claim 47 under 35 U.S.C. §112, Second Paragraph.**

The test for indefiniteness is whether the claim defines the patentable subject matter with a reasonable degree of particularity and distinctness. The requirement to "distinctly" claim means that the claim must have a meaning discernable to one of ordinary skill in the art. Only when a claim is insolubly ambiguous is it indefinite. *Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 71 USPQ2d 1081, 1089 (Fed. Cir. 2004).

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The Examiner appears to find the term "third layer" in claim 47 confusing because there is no first or second layer. However, the term "third layer" is not insolubly ambiguous and has a discernable meaning because one of ordinary skill in the art would count the claimed first and second coatings as first and second layers relative to the "third layer." Therefore, the term "third layer" has a discernable meaning, and the rejection should be reversed.

**III. Rejection of claims 1-14, 17, 18, 34, 36, 45, and 46 under 35 U.S.C. §103(a) over Kobayashi.**

The Examiner argues that the claimed arrangement of layers would have been an obvious matter of design choice since Appellant has not disclosed that the claimed arrangement would enhance the photocatalytic process or that the arrangement is for any particular purpose.

Regarding design choice, this is not by itself sufficient to support obviousness. There must be a motivation to modify the base reference (MPEP 2144.04(VI)(C)), which is missing from the rejection. For this reason alone, the rejection does not establish obviousness and should be reversed.

Regarding the Examiner's inference that Appellant must disclose that the claimed arrangement would enhance the photocatalytic process or that the arrangement is for any particular purpose, there is no such burden on the Applicant. The application establishes utility for all of the embodiments (e.g., page 2, paragraph 8). There is no further burden on Applicant to establish that the claimed structure would enhance the photocatalytic process or that the arrangement is for any particular purpose as the Examiner suggests, especially since the rejection does not establish *prima facie* obviousness. For this additional reason, the rejection is based on improper grounds and should be reversed.

**IV. Rejection of claim 35 under 35 U.S.C. §103(a) over Kobayashi in view of Reisfeld**

The Examiner argues that it would be obvious to use a honeycomb structure as in Reisfeld as a substrate for the photocatalyst system of Kobayashi because "the selection of any known equivalent

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substrates for the photocatalytic fluid purification would be within the level of ordinary skill in the art.”

The rejection is conclusory and does not provide any motivation for modifying the base reference. Whether or not the claimed limitations are known in the art does not alleviate the burden on the Examiner of providing motivation to establish obviousness. There must be some articulated reasoning that would prompt one of ordinary skill to combine the cited references as proposed, which is missing from the rejection. For this reason, the rejection is improper and should be reversed.

**V. Rejection of claims 7-12, 20, 33, 37, 38, 43, and 44 under 35 U.S.C. §103(a) over Kobayashi in view of Reisfeld**

(i) Claims 20, 37, and 38

Regarding independent claim 20 and its dependent claims 37 and 38, the Examiner admits that Kobayashi does not disclose the recited container and argues that it would have been obvious to include the container of Reisfeld in Kobayashi because “this would result in the application of Kobayashi’s photocatalytic material to a photocatalytic fluid purification system.” Respectfully, Appellant disagrees with the rejection because the given motivation that “this would result in the application of Kobayashi’s photocatalytic material to a photocatalytic fluid purification system” is merely a goal that the Examiner hopes to achieve by making the proposed combination rather than a reason that would prompt one of ordinary skill to combine the references. Therefore, the rejection does not establish motivation and should be reversed.

(ii) Claims 7-12, 33, 43, and 44

Regarding claims 7-12, 20, 33, 37, 38, 43, and 44, the Examiner argues that it would have been an obvious matter of design choice to provide the claimed arrangement of layers. However, as discussed above, design choice by itself is not sufficient to establish obviousness (MPEP 2144.04(VI)(C)). There must be motivation to modify the cited reference to meet the limitations of the

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claims, which is missing from the rejection. For this reason, the rejection is improper and should be reversed.

**VI. Rejection of claims 21-32, 39-42, and 47 under 35 U.S.C. §103(a) over Reisfeld in view of Kobayashi**

(i) Claim 21-32, 39-42, and 47

Regarding independent claim 21 and its dependent claims 22-32, 39-42, and 47, the examiner argues that it would have been obvious to modify Reisfeld with the compositions as shown in Kobayashi because "this would result in enhancing the photocatalytic fluid purification." However, the benefit that the claimed photocatalytic compositions would result in enhancing the photocatalytic fluid purification is only known through Applicant's disclosure. Thus, the rejection does not provide any motivation that would be known outside of Applicant's disclosure for selecting the claimed photocatalytic compositions. For this reason, the rejection is improper and should be reversed.

(ii) Claim 27

In addition to the reasons discussed above, dependent claim 27 would be allowable if rewritten in independent form. Regarding claim 27, the Examiner argues that Kobayashi discloses all of the layers and that through random rearrangement of the layers, one of ordinary skill in the art would be able to provide the claimed arrangement. As discussed above, mere rearrangement without motivation for the particular claimed arrangement of layers is not sufficient to establish obviousness (MPEP 2144.04(VI)(C)). For this reason, the rejection is improper and should be reversed.

(iii) Independent claim 47

Additionally, regarding claim 47, the Examiner argues that the claimed features would have been an obvious matter of design choice since Applicant has not disclosed that the claimed arrangement is for any particular purpose and that it also appears that Kobayashi's layers would perform equally well.

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Regarding design choice, as discussed above, this is not by itself sufficient to support obviousness. There must be a motivation to modify the base reference to meet the limitations of the claim (MPEP 2144.04(VI)(C)), which is missing from the rejection. For this reason alone, the rejection does not establish obviousness and should be reversed.

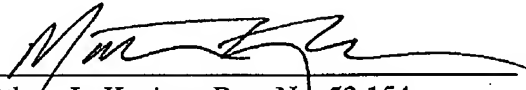
Regarding the Examiner's inference that Appellant must disclose that the claimed arrangement is for a particular purpose, there is no such burden on the Applicant. The application establishes utility for all of the embodiments (e.g., page 2, paragraph 8). There is no further burden on Appellant to establish that the claimed arrangement is for any particular purpose as the Examiner suggests, especially since the rejection does not establish *prima facie* obviousness. For this additional reason, the rejection is improper and should be reversed.

Additionally, the Examiner's speculation that Kobayashi's layers could or would perform equally well as Applicant's claimed arrangement of layers lacks an evidentiary basis and does not appear to have any relevance in an obviousness rejection. The inquiry under this obviousness rejection is whether there is motivation to modify the base reference to meet the limitations of the claim, which there is not. For this additional reason, the rejection is based on improper grounds and should be reversed.

#### CLOSING

For the reasons set forth above, the rejection of claims 1-14, 17, 18, and 20-47 must be reversed.

Respectfully Submitted,



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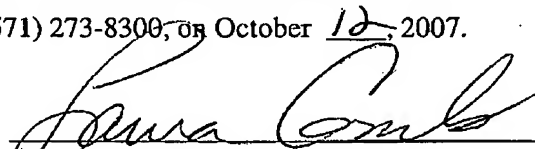
Dated: October 12, 2007



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Laura Combs

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### CLAIMS APPENDIX

1. A purification system comprising:  
a substrate having a first surface portion and a second surface portion adjacent the first surface portion; and  
a layered catalytic coating including a first layer of one of metal/titanium dioxide and metal compound/titanium dioxide applied on said first surface portion and a second layer of one of titanium dioxide and metal compound/titanium dioxide applied on said second surface portion.
2. The purification system as recited in claim 1 wherein said first layer is gold on titanium dioxide and catalytically oxidizes carbon monoxide to carbon dioxide and water.
3. The purification system as recited in claim 1 wherein said first layer is platinum/titanium dioxide and catalytically oxidizes low polarity organic compounds to carbon dioxide and water.
4. The purification system as recited in claim 3 wherein said first layer includes platinum on titanium dioxide, and said platinum has an increased affinity for said low polarity organic compounds, said low polarity organic compounds adsorb onto said platinum, and said hydroxyl radicals oxidize said low polarity organic compounds to carbon dioxide.
5. The purification system as recited in claim 1 wherein said first layer is manganese oxide/titanium dioxide and decomposes ozone.
6. The purification system as recited in claim 5 wherein said first layer includes manganese oxide on titanium dioxide, and said manganese oxide lowers an energy barrier of decomposition of said ozone to decompose said ozone to molecular oxygen.

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7. The purification system as recited in claim 1 further including a light source to activate said layered catalytic coating, and said layered catalytic coating oxidizes contaminants in an air flow that are adsorbed onto said layered catalytic coating when activated by said light source.
8. The purification system as recited in claim 7 wherein said light source is an ultraviolet light source.
9. The purification system as recited in claim 7 wherein photons from said light source are absorbed by said layered catalytic coating, forming a reactive hydroxyl radical that oxidizes said contaminant in the presence of oxygen and water, and said reactive hydroxyl radical oxidizes said contaminants to water and carbon dioxide.
10. The purification system as recited in claim 7 wherein said contaminants are one of a volatile organic compound and a semi-volatile organic compound including at least one of formaldehyde, toluene, propanal, butene, acetaldehyde, aldehyde, ketone, alcohol, aromatic, alkene, and alkane.
11. The purification system as recited in claim 10 wherein said volatile organic compounds have boiling point less than 200°C.
12. The purification system as recited in claim 10 wherein said semi-volatile organic compounds have boiling point equal to or greater than 200°C.
13. The purification system as recited in claim 1 wherein said second layer is metal compound/titanium dioxide including metal oxide on titanium dioxide, and said metal oxide is at least one of WO<sub>3</sub>, ZnO, SrTiO<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, V<sub>2</sub>O<sub>5</sub>, SnO<sub>2</sub>, FeTiO<sub>3</sub>, PbO, Co<sub>3</sub>O<sub>4</sub>, NiO, CeO<sub>2</sub>, CuO, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Cr<sub>2</sub>O<sub>3</sub>, and ZrO<sub>2</sub>.

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14. The purification system as recited in claim 1 wherein said second layer is porous.
17. The purification system as recited in claim 1 wherein said first layer is said metal compound/titanium dioxide including metal compound on titanium dioxide and said metal compound is metal oxide.
18. The purification system as recited in claim 1 wherein said second layer is metal compound/titanium dioxide including metal compound on titanium dioxide, and said metal compound is metal oxide.
20. A fluid purification system comprising:  
a container having an inlet and an outlet;  
a porous substrate inside said container, the porous substrate having a first surface portion and a second surface portion adjacent the first surface portion;  
a device for drawing a fluid into said container through said inlet, flowing said fluid through said porous substrate, and expelling said fluid out of said container through said outlet;  
a layered catalytic coating including a first layer of one of metal/titanium dioxide and metal oxide/titanium dioxide applied on said first surface portion and a second layer of one of titanium dioxide and metal oxide/titanium dioxide applied on said second surface portion; and  
an ultraviolet light source to activate said layered catalytic coating, and photons from said ultraviolet light source are absorbed by said layered catalytic coating to form a reactive hydroxyl radical, and said reactive hydroxyl radical oxidizes contaminants in said fluid that are adsorbed onto said metal/titanium dioxide catalytic coating when activated by said ultraviolet light source to water and carbon dioxide in the presence of water and oxygen.
21. A fluid purification system comprising:

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a first substrate having a first coating of one of metal/titanium dioxide and metal oxide/titanium dioxide; and

a second substrate having a second coating of one of titanium dioxide and metal compound/titanium dioxide.

22. The fluid purification system as recited in claim 21 wherein said first coating is gold/titanium dioxide and said second coating is metal oxide doped titanium dioxide.

23. The fluid purification system as recited in claim 22 wherein a metal oxide of said metal oxide doped titanium dioxide is at least one of  $\text{WO}_3$ ,  $\text{ZnO}$ ,  $\text{SrTiO}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{V}_2\text{O}_5$ ,  $\text{SnO}_2$ ,  $\text{FeTiO}_3$ ,  $\text{PbO}$ ,  $\text{Co}_3\text{O}_4$ ,  $\text{NiO}$ ,  $\text{CeO}_2$ ,  $\text{CuO}$ ,  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3$ , and  $\text{ZrO}_2$

24. The fluid purification system as recited in claim 22 wherein said first substrate is proximate to an inlet of the air purification system and said second substrate is distal to said inlet of said air purification system.

25. The fluid purification system as recited in claim 21 wherein said first coating is manganese oxide/titanium dioxide and said second coating is metal oxide doped titanium dioxide.

26. The fluid purification system as recited in claim 25 wherein a metal oxide of said metal oxide doped titanium dioxide is at least one of  $\text{WO}_3$ ,  $\text{ZnO}$ ,  $\text{SrTiO}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{V}_2\text{O}_5$ ,  $\text{SnO}_2$ ,  $\text{FeTiO}_3$ ,  $\text{PbO}$ ,  $\text{Co}_3\text{O}_4$ ,  $\text{NiO}$ ,  $\text{CeO}_2$ ,  $\text{CuO}$ ,  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3$ , and  $\text{ZrO}_2$

27. The fluid purification system as recited in claim 25 wherein said second substrate is proximate to an inlet of the air purification system and said first substrate is distal to said inlet of said air purification system.

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28. The fluid purification system as recited in claim 21 wherein said first substrate is adjacent to said second substrate.

29. The fluid purification system as recited in claim 28 wherein said first substrate is secured to said second substrate.

30. The fluid purification system as recited in claim 29 wherein said first substrate is secured to said second substrate by one of an adhesive or an attachment member.

31. The fluid purification system as recited in claim 28 further including a third substrate having a third coating of one of titanium dioxide, metal/titanium dioxide and metal compound/titanium dioxide and a light source, first substrate and said second substrate are located on a first side of said light source and said third substrate is located on an opposing second side of said light source.

32. The fluid purification system as recited in claim 21 further including a third substrate having a third coating of one of titanium dioxide, metal/titanium dioxide and metal compound/titanium dioxide and a light source, wherein said first substrate and said second substrate are located on a first side of said light source and said third substrate is located on an opposing second side of said light source.

33. A method of purification comprising the steps of:

applying a layered catalytic coating including a first layer of one of metal/titanium coating and metal oxide/titanium dioxide on a first surface portion of a substrate;

applying a second layer of one of titanium dioxide and metal oxide/titanium dioxide applied on a second surface portion of the substrate that is adjacent the first surface portion;

activating said layered catalytic coating;

forming a reactive hydroxyl radical;

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adsorbing contaminants in an air flow onto said layered catalytic coating; and  
oxidizing said contaminants with said hydroxyl radical.

34. The purification system as recited in claim 1 wherein said second layer is metal compound/titanium dioxide including metal oxide on titanium dioxide, and said metal oxide is manganese oxide.
35. The purification system as recited in claim 1 wherein said substrate is a honeycomb.
36. The purification system as recited in claim 1 wherein said first layer is a thermocatalyst.
37. The fluid purification system as recited in claim 20 wherein said porous substrate is a honeycomb.
38. The fluid purification system as recited in claim 20 wherein said first layer is a thermocatalyst.
39. The fluid purification system as recited in claim 21 wherein said first substrate and said second substrate are each a honeycomb.
40. The fluid purification system as recited in claim 21 wherein said first layer is a thermocatalyst.
41. The fluid purification system as recited in claim 22 wherein a metal oxide of said metal oxide doped titanium dioxide is manganese oxide.
42. The fluid purification system as recited in claim 25 wherein a metal oxide of said metal oxide doped titanium dioxide is manganese oxide.

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43. The method as recited in claim 33 wherein said first layer is a thermocatalyst.
44. The method as recited in claim 33 wherein said substrate is a honeycomb.
45. The fluid purification system as recited in claim 1, wherein said first layer is flush with said second layer.
46. The fluid purification system as recited in claim 1, wherein said first surface portion and said second surface portion extend in a first plane, and said first layer and said second layer extend in a second plane that is parallel to the first plane.
47. The fluid purification system as recited in claim 21, wherein at least one of the first substrate or the second substrate includes a first surface portion and a second surface portion adjacent the first surface portion, and the corresponding one of the first coating or the second coating is located on the first surface portion, and a third layer having at least one of metal/titanium dioxide, metal compound/titanium dioxide, or titanium dioxide is located on the second surface portion.



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**EVIDENCE APPENDIX**

None.

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**RELATED PROCEEDINGS APPENDIX**

None.